

Numerical Modeling and Performance Optimization Study of a Diaphragm Pump for Medical Application

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Abstract

In this contribution we present the results of a numerical modeling and performance optimization study of a diaphragm-metering pump for medical application. The main objective is to develop a numerical model that replicates the pumping cycle and which can also provide indications about its performance due to the variation of the geometry of the system chamber-diaphragm, materials and operating conditions. In the first part a brief description of the pump, calculation domain, boundary conditions and governing equations of the model will be presented. The structural behavior of the membrane subjected to the forces of the electromagnetic actuation system, in particular the effect of the different diaphragm material and the stress state with different geometry will be showed. The fluid dynamic effect of the diaphragm movement will be transferred to the fluid in the pumping chamber and then at intake-exhaust system. The results of the numerical simulations will be showed starting from different operating conditions in order to identify the geometric parameters limit and select the best solution for improving the pumping efficiency.

Figures used in the abstract

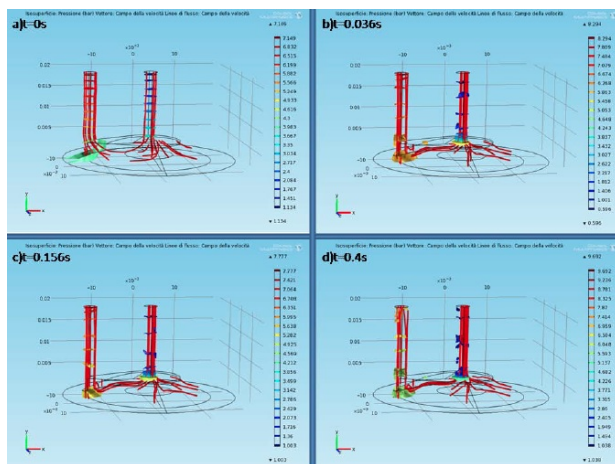


Figure 1: Pressure and velocity inside the pump chamber.